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IMPLEMENTATION GUIDE

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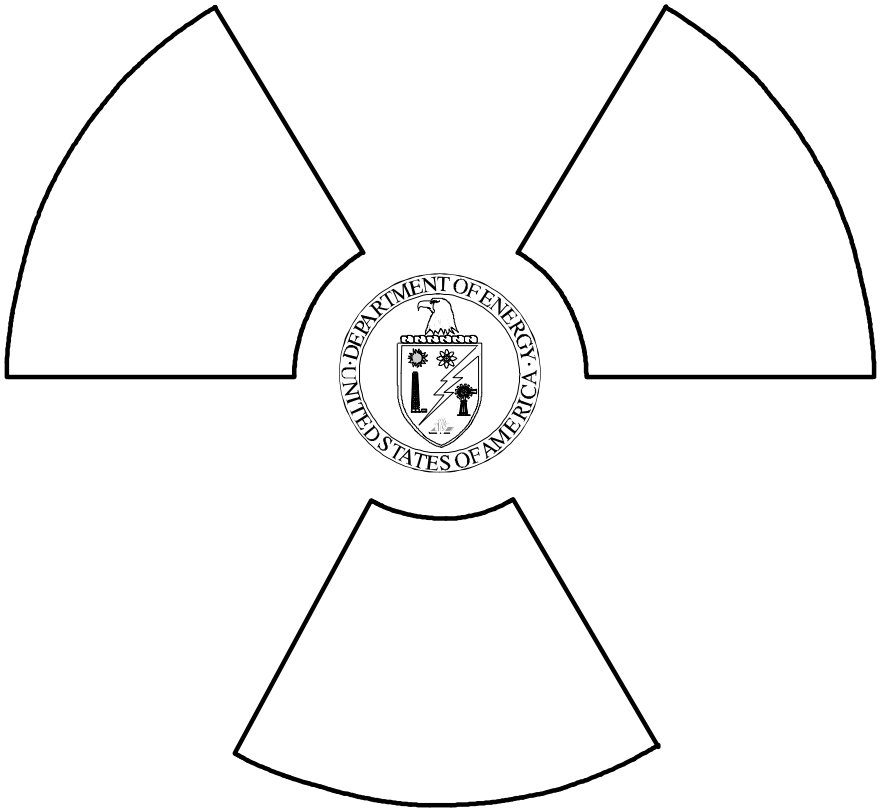
Title 10, Code of Federal Regulations, Part 835
OCCUPATIONAL RADIATION PROTECTION



RADIOACTIVE CONTAMINATION CONTROL

ASSISTANT SECRETARY for ENVIRONMENT, SAFETY and HEALTH

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U.S. Department of Energy
IMPLEMENTATION GUIDE

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I. PURPOSE AND APPLICABILITY

This Implementation Guide (IG) provides an acceptable methodology for establishing and implementing a contamination control program that will comply with U.S. Department of Energy (DOE) requirements specified in Title 10 of the Code of Federal Regulations (CFR), Part 835, Occupational Radiation Protection *(DOE, 1998a)*; hereinafter referred to as 10 CFR 835. In particular, this IG provides guidance for achieving compliance with certain provisions of Subparts E and L of 10 CFR 835. For completeness, this IG also provides cross-references to detailed guidance provided in DOE's Radiological Control Standard *(DOE, 1999a)*; hereinafter referred to as the RCS.

This IG amplifies the regulatory requirements of 10 CFR 835, which are enforceable under the provisions of Sections 223(c) and 234A of the Atomic Energy Act of 1954, as amended *(AEC, 1954)*.

Except for requirements mandated by a regulation, a contract, or by administrative means, the provisions in this IG are DOE's views on acceptable methods of program implementation and are not mandatory. Conformance with this IG will, however, create an inference of compliance with the related regulatory requirements. Alternate methods that are demonstrated to provide an equivalent or better level of protection are acceptable. Contractors are encouraged to go beyond the minimum requirements and pursue excellence in their programs.

The word "shall" is used in this IG to designate requirements from 10 CFR 835. The requirements of 10 CFR 835 are mandatory, except to the extent an exemption has been granted pursuant to 10 CFR 820, Procedural Rules for DOE Nuclear Activities *(DOE, 1997)*. The words "should" and "may" are used to represent optional program recommendations and allowable alternatives, respectively.

This IG is applicable to all DOE activities subject to the requirements of 10 CFR 835.

II DEFINITIONS

Terms defined in 10 CFR 835 are used in this IG consistent with their regulatory definitions.

contaminated area: Any area meeting the definition of “contamination area,” “high contamination area,” or

"airborne radioactivity area" provided in 10 CFR 835.2(a).

fixed contamination: Radioactive material that cannot be readily removed from surfaces by nondestructive means, such as casual contact, wiping, or brushing.

frisk or frisking: Process of monitoring individuals or surfaces for contamination by directly scanning the surface with a suitable radiation detector.

hot particles: Small, discrete, highly radioactive particles that can cause extremely high dose rates to a localized area.

removable contamination: Radioactive material that can be removed from surfaces by nondestructive means, such as casual contact, wiping, or brushing.

III. DISCUSSION

Work with unsealed quantities of radioactive material creates the potential for generating radioactive contamination. (Deleted text not pertinent to compliance with part 835) 10 CFR 835 requires, in part, a contamination control program sufficient to provide warning of the presence of surface contamination and to prevent the inadvertent transfer of contamination at levels exceeding specified values outside of radiological areas under normal operating conditions.

An acceptable contamination control program incorporates three types of control: (1) design control, (2) engineering control, and (3) administrative control. A contamination monitoring program is needed to verify the effectiveness of the contamination control program.

In implementing a contamination control program, physical design features that control contamination at the source are the most important element. Physical design features are generally incorporated during the construction or modification of a facility. Physical design features incorporated into older facilities may not be sufficient to meet modern contamination control standards. The second tier of controls in a contamination control program is engineering controls, including containment and ventilation, which may be the primary methods of controlling airborne radioactivity and internal exposures to workers in older facilities. While physical design features and engineering controls are similar, physical design features are generally incorporated during the design of a facility or modification to that facility, whereas engineering controls are used to control conditions during relatively short-term operations and maintenance and in other situations in which physical design features are unavailable or inadequate. For example, a permanently installed HEPA-filtered ventilation system may be included as a physical design feature in a facility to control airborne radioactive material concentrations during routine operations, but a temporary HEPA-filtered ventilation system may be used as an engineering control during certain maintenance activities. Similarly, a drain system may be included as a physical design feature to route contaminated fluids to a controlled collection point, but temporary drains may be installed as engineering controls during system breach. Finally, administrative controls, including access restrictions and the use of specific work practices designed to minimize contamination transfer, should be used as the tertiary method to control exposure to contamination hazards. These three elements of a contamination control program are not independent. The design of a facility will dictate the types and levels of administrative controls and engineering controls that are possible and necessary.

A contamination control program is an essential element of a comprehensive radiological control program. In this IG, when another element of a radiological control program interfaces with the contamination control program, the

appropriate implementation guide is referenced and the topic of interest is listed as it applies to contamination control. Because of these interfaces, individuals involved with the contamination control program should interact with personnel working in other elements of the radiological control program, particularly with individuals involved in instrument calibration, posting and labeling, air monitoring, internal and external dosimetry, ALARA, training, and record-keeping programs.

IV. IMPLEMENTATION GUIDANCE

Activities that have the potential to generate surface contamination should be evaluated to ensure appropriate controls are established. To the extent practicable, contamination controls should be consistent to facilitate effective implementation by affected individuals. This section describes methods for establishing and operating an acceptable contamination control program. The discussion is divided into the following topics: (1) Contamination Control Program Management, (2) Design Control, (3) Engineering Control, (4) Administrative Control, and (5) Contamination Monitoring.

A. Contamination Control Program Management

Common characteristics of effective contamination control programs include:

-- Strong written upper management commitment to control of contamination in the workplace;

-- consistent line management implementation of required controls through established procedures, training, and frequent supervision;

-- detailed work planning, including effective hazards analysis, pre-job briefings, and post-job debriefings; and

-- consistent program support by affected individuals.

Management commitment should be established in a written policy which may be established in the ALARA Policy statement or other policy-level document. The policy should be implemented by written procedures, technical work documents, and radiological work permits commensurate with the hazards and required controls and sufficient to ensure consistent program implementation given the education, training, and skills of the affected individuals. Guidance on developing written procedures is provided in Implementation Guide DOE G 441.1, Management and Administration of Radiation Protection Programs *(DOE, 1998c)*. Guidance on ensuring the appropriate education, training, and skills of affected individuals is provided in both DOE G 441.1 and DOE G 441.12, Radiation Safety Training *(DOE, 1998d)*. The radiological control manager should be responsible for the development of the contamination control program, including associated design reviews.

Contamination control is the responsibility of everyone involved in radiological activities. All individuals working with radioactive material should follow established procedures that meet or exceed the guidance provided in this IG and applicable DOE Orders and regulations. Line managers should be responsible for overseeing program implementation by their subordinates.

B. Design Control

10 CFR 835.1001 requires measures to be taken to maintain radiation exposure as low as reasonably achievable through physical design features and administrative controls. The primary methods used shall be physical design

features (e.g., confinement, ventilation, remote handling, and shielding). Administrative controls shall be employed only as supplemental methods to control radiation exposure (10 CFR 835.1001(a)).

Radiological control is affected by human performance and engineered design features. General design criteria for new facilities and major modifications to existing facilities are provided in 10 CFR 835, DOE Order 420.1, Facility Safety *(DOE 1995a)*, and the RCS. The design of facilities currently under construction or modification should be planned and evaluated for adherence to the applicable criteria. The effectiveness of design features should be evaluated through performance of area and individual monitoring. See Section IV.E of this IG and Chapter 5 of the RCS for further information regarding contamination monitoring.

Physical design features that should be considered to enhance control of workplace contamination include:

-- Containment of process materials to the maximum practicable extent;

-- components and materials that minimize leakage across seals;

-- catch basins and controlled drains from potential leakage points;

– use of multiple barriers as necessary to control the spread of contamination;

-- adequate working space around serviceable components to facilitate maintenance and repairs;

-- filtered ventilation from areas of lower to areas of higher contamination levels;

-- adequate space for donning and removal of protective clothing and individual frisking in low-background areas; and

-- location of office and break areas away from radiological areas.

In addition to the above, facility design, including materials selected, shall include features that facilitate operations, maintenance, decontamination, and decommissioning (10 CFR 835.1002(d)). Design features that limit the size of contaminated areas, to the extent practicable, may facilitate operations and maintenance by permitting ready access to facility equipment and controls. To the maximum possible extent, materials used should be readily decontaminated using non-hazardous compounds, particularly water or steam. Smooth, corrosion resistant surfaces and rounded edges also facilitate decontamination. More detailed information on design features is provided in Implementation Guide DOE G 441.2, Occupational ALARA Program *(DOE, 1998d)*, and Chapter 3 of the RCS.

C. Engineering Control

When physical design features are not sufficient to prevent the spread of contamination in the workplace, engineering controls, such as containment devices and portable or auxiliary ventilation, should be installed. These circumstances arise frequently during maintenance, modifications, and decontamination and decommissioning. Planning for such activities should include evaluation of the potential for contamination spread, evaluation of the effectiveness of engineering controls to reduce such potential, and, to the extent that engineering controls will not be effective, prescription of administrative controls as necessary to limit the spread of contamination.

Temporary containment devices may be particularly useful in controlling contamination spread resulting from system leaks and maintenance that requires contaminated system breach. These devices range in complexity from

simple plastic catch-basins suspended below leakage points to complex portable buildings that may be used to enclose an entire work area. Many commercially-available designs include provisions for glove and equipment ports, ventilation, and contamination reduction exit portals.

Portable air handling systems used in contaminated areas, including vacuum cleaners, should be equipped with HEPA-filtered exhausts or have their exhausts directed to installed systems that are so equipped. These provisions may not be necessary when these systems are used in areas where only tritium or radioactive noble gases are present or when the material to be vacuumed is wet enough to preclude resuspension after entry into the system collection chamber. Improper use of vacuum cleaners and portable air-handling equipment may result in the generation of airborne radioactive material or removable surface contamination. Extended use of air handling equipment may result in a significant build-up of radioactive material in the ductwork and filters. Periodic monitoring of the exhausted air and accessible surfaces of the equipment should be performed to assess the radiological impact of equipment operation. Chapter 4 of the RCS provides more detailed information regarding use of portable ventilation units and vacuum cleaners.

While the use of the devices discussed above has been proven effective in reducing contamination spread and the associated decontamination costs, these benefits must be weighed against the potential costs. Use of engineering controls may require expenditure of worker dose to set up, work in, maintain, and remove the device. There may be financial costs associated with device purchase or manufacture, training, possible reduced productivity, and device or component maintenance and disposal. These factors are considered in implementation of an effective ALARA program, which is discussed in more detail in Implementation Guide G 441.2, Occupational ALARA Program.

D. Administrative Control

When the use of additional physical design features and engineering controls to limit individual exposures is impractical, administrative controls shall be implemented to maintain exposures ALARA (10 CFR 835.1001(b)). Appropriate controls that prevent the inadvertent transfer of removable contamination to locations outside of radiological areas under normal operating conditions shall be maintained and verified (10 CFR 835.1102(a)). To control the spread of contamination and limit individual exposures, a graded, multiple-tier system should be used in and around contaminated areas. The effectiveness of the controls should be verified through the conduct of contamination monitoring, as discussed in Section E of this IG and Chapter 5 of the RCS.

1. Work Authorizations

Guidance on the use of work authorizations is provided in Implementation Guide G 441.2, Occupational ALARA Program, and Chapter 3 of the RCS.

2. Access Control

Control of entry to contaminated areas is necessary to ensure that personnel entering the area are informed of the radiological status and potential hazards and are provided with the appropriate protective apparel and equipment. Control of egress from contaminated areas ensures that radioactive material is not inadvertently removed from the area by personnel or equipment. Efforts should be made to limit the size and number of contaminated areas in the facility, thereby limiting the need for use of protective clothing and the undesirable side effects of restricted access to facility equipment, heat stress, and radioactive waste generation.

Entry Controls

Protective clothing shall be required for entry into contaminated areas where removable contamination exceeds the values provided in Appendix D of 10 CFR 835 (10 CFR 835.1102(e)). The type of protective clothing required should be prescribed based upon considerations of contamination levels, chemical and physical form of the contaminant, activities to be performed, and area accessibility. Other area and activity hazards, such as heat, flame, hazardous chemicals, physical obstructions, electrical shock, and limited visibility, should be considered when prescribing protective clothing. Multiple layers of protective clothing should be prescribed for areas in which the removable contamination levels exceed 10 times the values provided in Appendix D of 10 CFR 835. When penetration of the protective clothing by the contaminant is likely, such as during activities likely to induce heavy sweating or otherwise wet the individual, an additional layer of impenetrable clothing should be considered. In some cases, provision of an impenetrable plastic sheet for sitting or kneeling will be adequate and will reduce the hazards of heat stress. Additional guidance is provided in Chapter 3 of the RCS.

Prior to unescorted access to radiological areas (including contaminated areas) and prior to performing unescorted radiological work, each individual shall complete radiation safety training commensurate with the hazards in the area and the required controls (10 CFR 835.901(c)). Guidance on radiation safety training is provided in Implementation Guide G 441.12, Radiation Safety Training *(DOE, 1998f)*, and Chapter 6 of the RCS.

Egress Controls

Exits from contaminated areas should include provisions to facilitate retention of contamination in the area and for monitoring of individuals and the area to ensure control has been maintained. Undress methods should be prescribed to minimize the potential for contamination spread. When complex methods are necessary for removal of multiple layers of protective clothing, assistance should be provided.

Individuals exiting contaminated areas shall be monitored, as appropriate, for the presence of surface contamination (10 CFR 835.1102(d)). At a minimum, individuals exiting contaminated areas should perform a whole body frisk, using either portable or automated devices. The use of automated whole body frisking devicesshould be considered due to the consistency of results achievable with such devices. For individuals exiting areas where the only contaminated areas are laboratory bench surfaces or fume hoods, or where contamination potential is limited to specific portions of the body, the frisking should concentrate on those areas of the body. Exiting individuals should be trained to frisk any personal items carried into the area. Personal items include papers, pens, jewelry, security badges, dosimeters, and other items commonly used within the area, but should not be expanded to include tools or other items likely to have had significant contact with contaminated surfaces.

The instruments and techniques used for contamination monitoring shall be approrpiate for the types, levels, and energies of the radiations encountered and for the existing environmental conditions, be periodically calibrated and maintained, and be routinely tested for operability (10 CFR 835.401(b)). Detailed guidance on selection, calibration, and use of portable contamination control instruments is provided in Implementation Guide DOE G 441.7, Instrument Calibration for Portable Survey Instruments *(DOE, 1998g)*, and Chapter 5 of the RCS.

Because certain radiosotopes, such as tritium, cannot be reliably detected by currently available hand-held or automated monitoring instrumentation, individual frisking is not an appropriate means of detecting surface contamination, as discussed in 10 CFR 835.1102(d). When individual exposure to such contamination hazards is possible, additional emphasis should be placed on radiobioassay programs and routine contamination and air monitoring programs. Detailed guidance on radiobioassay and air monitoring programs is provided in Implementation Guides G 441.3, Internal Dosimetry Program *(DOE, 1998h)* and G 441.8, Air Monitoring *(DOE, 1998i)*, respectively.

If background radiation levels at the exit point preclude performance of personnel frisking, the exit point should be

relocated to an area of lower background levels. If relocation of the exit point is not practicable, individuals should proceed directly from the exit point to an area of lower background to perform a whole body frisk. The travel path should be monitored frequently for contamination spread during use and after the detection of any contamination at the frisking station.

The instruments used for frisking should be capable of detecting contamination at or below the total surface contamination values provided in Appendix D of 10 CFR 835. Individuals should be trained in proper frisking techniques, including detector speed and distance, and proper techniques should be enforced through frequent line management observation. Frisking for skin contamination while wearing protective clothing will not generally provide detection capability adequate to ensure compliance with 10 CFR 835. Frisking for hot particles may require special techniques and should reflect considerations of source to detector size effects. Such factors should be included in radiation safety training and reinforced through line management attention.

3. Areas of Fixed Contamination

The control measures discussed above have been proven effective in minimizing the generation and spread of removable contamination. However, these measures may not be appropriate for implementation in areas having only fixed contamination. When surfaces with fixed contamination are located within a radiological area, the radiological area posting and entry control requirements provide for adequate control of entry and egress. Additional control measures may be necessary to prevent inadvertent or unauthorized removal of the fixed contamination by methods that disturb the surface. 10 CFR 835 establishes specific requirements for controlling such areas that are located outside of radiological areas. Although fixative coatings may be used to bind the contamination to the surface, such usage should be minimized and removable contamination levels should be reduced to levels that are ALARA prior to application of the coating.

When located outside of radiological areas, accessible areas in which only the fixed contamination levels exceed the total surface radioactivity values provided in Appendix D of 10 CFR 835 (removable contamination levels are below the Appendix D removable surface radioactivity values) shall (10 CFR 835.1102(c)):

-- Be routinely monitored to ensure removable surface contamination levels remain below the Appendix D values. Monitoring should be conducted in and around the area using techniques discussed in Section IV.E of this IG; and

-- be conspicuously marked to warn individuals of the contaminated status. The marking may consist of stencils on affected surfaces or, where multiple surfaces exist in a single enclosure, postings established at each access point. The marking should include the radiation warning trefoil and the words "Caution, Fixed Contamination" and should provide radiation protection instructions sufficient to prevent inadvertent removal of the contamination.

Additional guidance on labeling of items having only fixed contamination is provided in Implementation Guide G 441.10, Posting and Labeling for Radiological Control. Additional information on control of fixed contamination is provided in Chapter 2 of the RCS.

4. Conduct of Radiological Work

Work in contaminated areas should be conducted in a manner that minimizes the spread of contamination to adjacent surfaces, individuals in the area, and the workplace atmosphere. The following controls and techniques should be included in work planning and employee training:

-- Minimization of individuals and materials entering contaminated areas;

-- establishment of a dedicated contaminated tool program, if justified by the extent of contaminated area work activities;

-- use of proven work techniques to minimize contamination spread, including techniques to minimize the release of hot particles;

-- judicious use of stop-work authority to correct radiological problems before they escalate;

-- judicious work area monitoring to detect, and decontamination to reduce, contamination spread; and

-- priority repair of leaks to minimize the spread of contamination.

Chapter 3 of the RCS provides more information on these issues.

5. Personnel and Material Decontamination

Two types of personnel contaminations can occur: skin (or personal clothing) contamination and wound contamination. In this context, personal clothing includes work clothing provided by the employer, but does not include protective clothing provided solely for contamination control purposes. Potential internal contamination caused by exposure to airborne radioactive material is discussed in Implementation Guide G-10 441.3, Internal Dosimetry Program, and Chapter 5 of the RCS.

Skin and Clothing Contamination

When individuals detect skin (or personal clothing) contamination, they should notify the radiological control organization to ensure adequate characterization of the potential for significant skin dose. A qualified radiological control organization representative should:

-- Assess the extent of the contamination;

-- retain samples of the contamination (particularly hot particles) as necessary to perform a detailed dose assessment. Levels of contamination that trigger the need for dose assessments should be established for site-specific radionuclides. These trigger levels should not exceed 100 millirem (shallow dose equivalent); and

-- initiate decontamination procedures using methods that minimize skin abrasion and changes in pore size.

Skin decontamination methods should be established for site-specific radionuclides. Skin abrasion should be avoided during the decontamination process. Intrusive decontamination methods, such as tissue removal, require medical assistance. Contaminated personal clothing should be decontaminated by laundering or other appropriate methods, monitored, and returned to the owner or, if necessary, disposed of as radioactive waste.

Wound Contamination

Medical treatment of injuries takes precedence over radiological considerations. Emergency medical care should be administered immediately for injuries involving radioactive materials in accordance with National Council on Radiation Protection and Measurements Report Number 65, Management of Persons Accidentally Contaminated with Radionuclides *(NCRP, 1980)*.

Material and Area Decontamination

In general, water and steam are the preferred decontamination agents. Other cleaning agents should be selected based upon their effectiveness, hazardous properties, amount of waste generated, compatibility with the contaminated surface and other systems or items that may be contacted (including protective clothing and waste handling systems), and ease of disposal.

E. Posting and Labeling

Guidance on area posting and contaminated item labeling is provided in Implementation Guide G 441.10, Posting and Labeling for Radiological Control *(DOE, 1998e)*, and Chapter 2 of the RCS.

F. Contamination Monitoring

Comprehensive surveillance for contamination is the best available assurance of compliance with the requirements of 10 CFR 835. Frequent routine and special contamination monitoring should be performed in and around contaminated areas to verify the levels and locations of contamination and to alert personnel to changes in levels that result from incidents and accidents.

An effective contamination monitoring program includes the capability to calibrate instruments and perform appropriate operational tests, monitor for contamination, determine the lower detection limits both for field and laboratory instruments, and conduct the appropriate quality control checks to assure reliable instrument performance.

1. Contamination Guideline Values

Appendix D of 10 CFR 835 establishes values above which contamination controls, including posting, access controls, and radioactive material controls must be implemented. The contamination monitoring program should be sufficient to identify the location of surfaces having contamination at such levels. Contamination levels on surfaces outside of contaminated areas should be maintained below the applicable Appendix D values and as low as is reasonably achievable.

The footnotes to Appendix D of 10 CFR 835 provide guidance on appropriate means of determining the surface contamination levels and comparing these levels against the controlling values. Footnote 3 to Appendix D of 10 CFR 835 indicates that the contamination levels may be averaged over an area of one square meter. When averaging contamination levels over a square meter, the applicable Appendix D value shall be considered to have been exceeded if:

-- The average contamination level in the one square meter area exceeds the applicable Appendix D value; or

-- the sum of the activity in all isolated spots or particles in any 100 square centimeter area exceeds three times the applicable Appendix D value. In practice, this condition may be determined by taking smears of approximately 100 square centimeters and ensuring that the contamination level on the smear is less than three times the applicable Appendix D value.

There are two different scenarios under which combinations of radionuclides may be present as radioactive surface contamination:

-- There may be a combination of radionuclides all of which are within the same 10 CFR 835 Appendix D

category; or

-- there may be a combination of radionuclides in different 10 CFR 835 Appendix D categories.

If a surface is contaminated with radionuclides all of which fall within the same 10 CFR 835 Appendix D category, then the contamination levels of the various radionuclides should be summed to determine if contamination level in any area monitored exceeds the applicable Appendix D value. For example, if a surface is contaminated with both U-235 and U-238, then the contamination levels of both radionuclides should be summed to determine whether or not the applicable Appendix D value has been exceeded.

If a surface is contaminated with a combination of radionuclides in different 10 CFR 835 Appendix D categories, then the values provided in Appendix D of 10 CFR 835 may be considered to be independent of one another. It is not necessary to perform a sum of the fractions calculation to determine if the contamination levels in any area monitored exceed the applicable Appendix D value. For example, if a surface is contaminated with both U-235 and Sr-90, then the contamination levels of the two radionuclides may be compared independently to the applicable Appendix D values. Although it is permissible to do so, there is no need to sum the U-235 and Sr-90 contamination levels or their fractions relative to the applicable Appendix D values. In practice however, it is often more convenient to determine the sum of the contamination levels of the various radionuclides and to compare this figure to the most conservative applicable Appendix D value.

2. Monitoring

Individual and area monitoring shall be performed to document radiological conditions in the workplace, detect changes in radiological conditions, detect the gradual buildup of radioactive materials in the workplace, verify the effectiveness of engineering and process controls in containing radioactive materials and identify and control potential sources of individual exposure to radiation and/or radioactive material (10 CFR 835.401(a)). Monitoring frequencies should be established based on potential and actual radiological conditions, probability of change in conditions, and area occupancy factors. The contamination monitoring program should incorporate the following features:

-- Scheduled routine monitoring for removable contamination and, where feasible, fixed contamination. Schedules should be adjusted to reflect changes in conditions, activities, and previous results;

-- special monitoring as necessary to accomodate planned events, such as maintenance and repairs, barrier breach or leakage, material movement, and unplanned events such as spills;

-- sample analysis and monitoring using instruments and techniques capable of detecting contamination below the values specified in Appendix D of 10 CFR 835. To provide for early warning of changes, a sample of smears taken from areas surrounding contaminated areas should be analyzed for contamination at levels below the Appendix D values;

-- documentation of survey results;

-- timely documented review of results for trends and changes and the need for further action, such as decontamination, posting, changes in monitoring frequency, and access controls; and

-- provision of results for use by individuals planning work in or entering the area.

Monitoring for removable contamination should be conducted using conventional smear techniques for quantitative

analyses and, where practicable, large-area smears for qualitative analyses. The use of large-area smears, adhesive pads or adhesive rollers is also helpful in identifying hot particles. Direct frisking is necessary for detecting fixed contamination; however, the application of direct frisking may be limited by background radiation levels. Techniques should be developed and documented to ensure that monitoring efforts collect data representative of the entire surface, with special attention paid to likely points for collection of contamination, such as leakage points, rough surface areas, areas that are infrequently cleaned, current work areas, and high traffic areas.

Because of difficulties in implementing conventional removable contamination monitoring techniques (e.g., smear surveys), the presence of radioactive contamination in or on soil or other surfaces contaminated with granular solids may present significant challenges to the contamination monitoring program. Although the measurement of contamination levels in the granular solid (on a quantity of radioactive material per weight or volume basis) may be relatively straightforward, it may be difficult to compare the results of such measurements to the 10 CFR 835 Appendix D values, which are provided in units of contamination levels per unit area. Such comparisons are necessary to ensure compliance with the 10 CFR 835 requirements for posting and area and material control. DOE recognizes the difficulties associated with such measures. To ensure compliance, an assessment should be performed to determine the likelihood that radioactive contamination may be dispersed from the surface in question to surrounding areas or to items or individuals who may come in contact with the surface. The assessment may include a review of the operating history to determine whether significant contamination dispersion has occurred in the past, calculations based on realistic dispersion scenarios, performance of tests to determine the magnitude of contamination dispersion under actual operating conditions, or other technically defensible measures. If the results of the assessment indicate that contamination at levels exceeding the 10 CFR 835 Appendix D values is likely to be dispersed from the contaminated surface to surrounding or contacting surfaces, then the surface in question should be considered contaminated at levels exceeding the Appendix D values and appropriate protective actions (e.g., posting, protective clothing, access controls) should be taken.

Additional information regarding requirements for instruments and documentation is provided in Implementation Guides DOE G 441.7, Instrument Calibration for Portable Survey Instruments, and DOE G441.11, Occupational Radiation Protection Record-Keeping and Reporting *(DOE, 1998j)*, respectively and in Chapters 5 and 7 of the RCS.

3. Control of Material and Equipment

Material release from contaminated areas presents special challenges. Many items have surfaces that are inaccessible, making adequate monitoring of surface contamination difficult. Surveys of large items and vehicles can be time consuming and difficult in inclement weather. For these reasons, to the maximum extent practical, materials and equipment that enter contaminated areas should be retained there.

Except as noted below, any material that enters contaminated areas shall be retained there if (10 CFR 835.1101(a)):

-- Monitoring of accessible surfaces indicate the presence of removable surface contamination at levels exceeding the removable surface contamination values provided in Appendix D of 10 CFR 835; or

-- prior use of the material indicates that removable surface contamination levels on inaccessible surfaces are likely to exceed these levels.

Material control programs should include features that:

-- Provide for assessment of the likelihood of material contamination through documentation of material location

and use, monitoring of material surfaces, or a combination of these techniques;

-- where monitoring is necessary, include monitoring for both fixed and removable contamination;

-- for materials with inaccessible surfaces that are likely to be contaminated, require disassembly to the extent necessary to perform monitoring on those surfaces;

-- require reduction of surface contamination before release to levels that are as low as reasonably achievable; and

-- require retention of materials having contamination levels in excess of the values provided in Appendix D of 10 CFR 835.

Under certain circumstances, materials having removable surface contamination levels in excess of the values provided in Appendix D of 10 CFR 835 may be released to controlled areas. Materials having either removable or total contamination levels in excess of these values may be released for movement to another radiological area. Appropriate monitoring and controls shall be implemented (10 CFR 835.1101(b)). These controls should include:

-- Determining the contamination levels before movement;

-- wrapping or containing the material to prevent the spread of contamination;

-- applying appropriate labels to the material and postings at the destination;

-- selecting the transport path to minimize the potential for contamination spread; and

-- monitoring the transport path as necessary after movement to ensure that contamination has not been spread.

Materials having fixed contamination in excess of the total surface radioactivity values provided in Appendix D of 10 CFR 835 may be released for use in controlled areas. Release of such materials shall require that (10 CFR 835.1101(c)):

-- Removable contamination levels be below the values provided in Appendix D. Contamination levels should be assessed in accordance with the guidance provided in this IG;

-- routine monitoring be conducted. The monitoring should be adequate to ensure that the radiological hazard resulting from the release is fully characterized and that appropriate posting, labeling, and access control measures are implemented; and

-- the material is clearly marked or labeled. Guidance for material labeling is provided in Implementation Guide G-441.10, Posting and Labeling for Radiological Control, and Chapter 4 of the RCS

Written records of material release monitoring are required (10 CFR 835.703(c)). These records should include:

-- A description of the material. Where large quantities are involved, a simple entry such as "box of nails" or "tool box full of hand tools" is adequate;

-- monitoring date;

-- identity of individual performing the monitoring;

-- survey meter type and identification number; and

-- monitoring results.

The provisions of 10 CFR 835 do not apply to release of materials from controlled areas. These activities are subject to DOE standards for protection of the environment.

4. Portal Monitors, Laundry Monitors, and Tool Monitors

The use of automated monitoring devices for evaluating material for release to controlled areas is encouraged. Automated monitoring devices are typically large gas proportional or plastic scintillation detectors arranged in a shielded counting chamber into which objects may be placed. When used, the monitor counts the object using a count time sufficient to achieve the desired confidence level and compares the net count rate from the object with a pre-determined alarm set point.

Automated monitoring devices are appropriate for monitoring of the external surfaces of non-porous, industrially clean objects. Objects with potential internal contamination should be surveyed using portable survey instruments. In general, automated monitoring devices are not appropriate for releasing porous material that has been contaminated in depth (e.g., wood, concrete) or in volume (e.g., activated material, smelted contaminated material). However, such devices may have limited application to monitoring of items contaminated in depth or volume by radioisotopes that emit high energy gamma radiation.

V. REFERENCES

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REQUEST FOR CHANGES TO IMPLEMENTATION GUIDE ON RADIOACTIVE CONTAMINATION CONTROL AND MEASUREMENT

(Use Multiple Pages as Necessary)

Page No. _____

Section No. _____

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_____
Facility Requesting Change

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Contact Person

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Telephone Number - Fax Number

Description of Change Request:

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Suggested Specific Word Changes:

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